MODULAR FLOORING INSTALLATION TECHNIQUES AND EQUIPMENT

This application claims the benefit of U.S. Provisional Patent Application No. 60/372,269, filed April 11, 2002, entitled "Modular Flooring Installation Techniques and Equipment," the entire contents of which are hereby incorporated by reference. This application is a continuation-in-part of U.S. Patent Application No. 09/882,849, filed June 15, 2001, now pending, entitled "Modular Floor Covering Edge Treatment," which is a continuation-in-part of International Patent Application No. PCT/US00/01717, filed January 25, 2000, entitled "Modular Floor Covering Edge Treatment," the entire contents of each of which are hereby incorporated by reference.

Field of the Invention

This invention relates to carpet tile and other modular flooring having a textile face and to moldings and the use of polymer moldings in installing flooring.

Background of the Invention

Flooring having a textile top surface or face has long been used in an enormous variety of configurations. Beginning in the 1970s, modular carpet or "carpet tile" began to be widely used in office and other commercial applications because of a wide variety of attractive properties of such products. Historically, one of the principal objectives associated with such products was achievement of installations that look like broadloom carpet and in which it is difficult, if not impossible, to identify the presence of individual carpet modules.

More recently, designers and customers have become comfortable with flooring installations in which the use of flooring modules is readily apparent. For instance, some

modular carpet installations have "quarter turned" adjacent modules so that at least the nap, if not a directional pattern, changes from one tile or module to the next. In other situations, manufacturers or installers have consciously sought to create visual demarcation lines between adjacent modules, in some instances mimicking the appearance of grout between adjacent ceramic tiles. Some of the techniques and equipment utilized for accomplishing such appearance are disclosed in U.S. Patent Application No. 09/882,849, filed June 15, 2001 entitled "Modular Floor Covering Edge Treatment;" International Patent Application No. PCT/US00/01717, filed January 25, 2000, entitled "Modular Floor Covering Edge Treatment;" and International Patent Application No. PCT/US01/02076, filed January 22, 2001, entitled "Apparatus and Methods for Imparting Grouted Edge Appearance to Floor Coverings Modules During Installation," all of which applications are incorporated by reference herein.

Modular flooring materials have also continued to evolve, and aspects of that evolution have created new challenges. For instance, modular flooring has been developed with a woven textile face in which all textile yarns are oriented substantially horizontally. Such flooring is described in U.S. Patent Application No. 09/882,852, filed June 15, 2001, entitled "Floor Covering With Woven Face," which is a continuation-in-part of U.S. Patent Application No. 09/529,464, filed January 19, 2000, which is a continuation-in-part of International Patent Application No. PCT/US98/21487, filed October 13, 1998, which claims the benefit of both U.S. Provisional Application No. 60/062,085, filed October 14, 1997, and U.S. Provisional Application No. 60/087,991, filed June 4, 1998, the entire contents of each of which are hereby incorporated by reference.

Textile face flooring having yarns oriented substantially horizontally necessarily has cut yarn ends at flooring edges. Such yarn ends can fray and be unsightly, and abutting yarn ends of adjacent such modules are visually readily apparent. Accordingly, there is a need for techniques for dealing with yarn ends at the edges of flooring and flooring modules. Additionally, some flooring is essentially moisture impermeable except at the interfaces between adjacent flooring. It is desirable in some flooring installations of such moisture impermeable flooring to provide a moisture seal between adjacent flooring modules or other flooring pieces. Finally, as described above, it is often desirable to provide a decorative appearance or the appearance of "grouted edges" between adjacent flooring modules.

Summary of the Invention

These and other objectives are achieved in this invention by utilizing a polymeric molding or adhesive strip having a T-shaped cross section that is positioned with the upright of the "T" between adjacent flooring modules or other flooring and in contact with the ends of yarns in the modules or other flooring. Heat and pressure are then applied to the molding in order to melt the molding and bond at least the "T" cross section to the textile fibers in contact with it and, in some instances, to impart a desired top surface appearance to the molding. By utilizing a material for the T-shaped molding that has a melting point on the order of 200 degrees Fahrenheit lower than that of the fibers typically used in textile face flooring modules, the T-shaped molding may be installed without risk of melting or otherwise damaging the modular or other flooring textile fibers.

Installation of the molding may be achieved by positioning the flooring modules or other flooring on a subfloor on which they are to be installed and then traversing each of the "seams" defined by abutting edges of the flooring with a molding applying machine. This installation machine may have a reel from which molding is fed into position between adjacent flooring. Heat is applied to soften the molding, typically with a hot air gun, and substantial pressure is applied with a wheel that can also emboss the molding with a desired pattern as the wheel forces the molding down into and between adjacent modules or other flooring.

The molding thus captures and adhesively bonds yarn ends while providing an aesthetically pleasing, visually contrasting, uniform strip at the line of demarcation between adjacent flooring. Among other materials usable for the plastic strip or molding of this invention is ethylene vinyl acetate that softens at approximately 250-275°F, which is on the order of 200°F lower than the temperature at which carpet fibers normally begin to singe or melt.

The installation techniques, molding, and equipment of this invention can be used between any abutting flooring for which it is appropriate, including both broadloom and modular flooring.

Brief Description of the Drawings

Figure 1 is an enlarged end or cross sectional view of one embodiment of a T-shaped molding of this invention.

Figure 2 is a perspective view showing the left side of a molding installation apparatus of this invention.

Figure 3 is a perspective view showing the front of the molding installation apparatus of Figure 2.

Figure 4 is a top view of the molding installation apparatus of Figure 2.

Figure 5 is a perspective view of the top of the molding installation apparatus of Figure 2 shown positioned on a test installation of flooring modules within which T-shaped molding has been installed in accordance with this invention.

Figure 6 is a close up view of the front of the molding installation apparatus of Figure 2 with the blade portion of the seam follower foot shown in position in a seam.

Figure 7 is a perspective view of the right side, front, and top of an alternative embodiment of the molding installation apparatus of Figure 2 shown positioned to install molding in accordance with this invention between broadloom or roll goods flooring.

Figure 8 is a perspective view of an alternative embodiment of the molding installation apparatus of Figure 2.

Detailed Description of the Invention

A molding 10 of this invention may have the configuration illustrated in Figure 1. The molding may be formed of extruded ethylene vinyl acetate such as EVA resin product # 52,561 (melt point: 220° Fahrenheit; nominal viscosity: CP 36,000; melt index: 2500) available from The Reynolds Company, P.O. Box 1925, Greenville, South Carolina 29602. A variety of different ethylene vinyl acetate materials and other materials may be used in practicing this invention, provided that they have appropriate adhesive, sealant, melting, appearance, color, and other properties. For instance, it may be possible to use mineral or glass filler with ethylene vinyl acetate like that described above or having a different viscosity.

Additionally, molding or sealant strips having shapes other than a T-shaped cross section may also be used successfully in some applications. A T-shaped cross section is desirable because it positions adhesive material between the modules and therefore in contact with textile yarn ends as well as on top of the modules at least initially to provide an aesthetically appealing and functionally attractive structure. T-shaped cross section molding can be obtained (by specifying the desired shape and material) from American Extruded Plastics, 938 Reynolds Place, Greensboro, North Carolina 27430.

In order to install molding in accordance with this invention, it is necessary to position molding 10 at the intersection between adjacent flooring modules 16 and 18 and then apply appropriate heat and pressure to soften molding 10 so that it can be pressed down against and into at least the top most structure of flooring modules 16 and 18. Such heat may, for instance, be applied using a hand-held heat gun such as a Leister model CH 6060 or Triac S, which may be used with an appropriate tool for pressing and compressing the heated molding, such as a putty knife, wheel or roller, or other suitable tool for applying pressure. Indeed, such hand installation of molding 10 is typically necessary even in installations utilizing the mechanized equipment and techniques described below in at least small portions of the installation area not accessible to an installation machine. Installation of molding 10 can also be accomplished by heating molding 10 by direct contact with a heat source such as a heated iron, or by direct contact except for a release paper or film between the heat source and molding 10.

Figures 2 and 3-6 illustrate one embodiment of a molding installation machine 20 of this invention. Figure 8 illustrates an alternative embodiment of the molding installation apparatus of Figure 2, including a heat shield 48 and a voltage regulator 35. Figure 7 depicts another embodiment of a molding installation machine 20' of this

invention with differently configured components and shows molding installation machine 20' being used to install molding 10 between lengths 54 and 56 of broadloom or roll goods flooring rather than modular flooring.

Mechanized molding installation in accordance with this invention can be accomplished with equipment in numerous different configurations. Generally, such equipment needs to be capable of traversing a floor on which flooring modules or roll goods have been placed while following a seam line between adjacent modules. The machine must supply a length of molding 10, position molding 10 along the seam line at the intersection between adjacent flooring modules or lengths of flooring, heat molding 10, and then compress the heated molding into position, imparting any desired surface treatment.

In a first embodiment of such an installation machine 20 shown in Figures 2-6, molding 10 is fed from a reel 22 through a guide 24 and feedway 26 under a spring metal foot 28 that presses molding 10 against flooring 50. Machine 20 is maintained in the desired position by positioning a seam follower foot 30 over the seam. Seam follower 30 can best be seen in Figures 3 and 6. Seam follower 30 can have a blade 32 that travels in a seam 52 to open the seam so that the upright portion 12 of molding 10 will slip into place and to facilitate guiding machine 20.

An electric drive motor 34 imparts power to wheels 36 and 38 in order to cause machine 20 to travel at a desired, preferably adjustable, rate. As machine 20 travels to the left in Figure 2, heat is directed against molding 10 by a nozzle 40 of a heat gun 42. Optionally, a voltage regulator 35, as shown in Figure 8, may be included in the drive motor circuit so that a constant voltage level to drive motor 34 is maintained while the heater of heat gun 42 cycles on and off, thus resulting in no speed oscillations. With

appropriate heat and speed of travel, horizontal or cross-bar portion 14 of T-shaped molding 10 becomes molten just prior to contact with an embossing wheel or roller 44. Wheel 44 then presses against molding 10 in order to compress it, press it down into flooring 50 and, if desired, to impart a surface pattern to molding 10. For instance, wheel 44 can be knurled to impart an attractive rough texture. Wheel 44 may also have a smooth face or other texture. Wheel 44 is pressed against molding 10 by weights 46. Optionally, a heat shield 48, as shown in Figure 8, may be provided to assist in preventing wheel 44 from overheating.

Machines 20 and 20' shown in the figures may be fabricated by modifying a Leister Universal machine that is produced for use, for instance, in seaming landscape fabrics. Among other modifications, the reel 22, guide 24, wheel 44, weights 46, seam follower 30, spring metal foot 28, voltage regulator 35, and heat shield 48 components were added, and other components were re-configured. For instance, the separation between running wheels 36 and 38 was increased by positioning wheel 38 at a greater distance from wheel 36, and the position of heat gun 42 was changed.

As should be appreciated by those skilled in the art, other configurations could be used for providing machines 20 or 20' provided it remains possible to position, heat, and manipulate molding 10 as described above. For example, components such as the position of weights 46 and wheel 44 can be changed, as they are on machine 20' shown in Figure 7, where machine 20' is shown in use to install molding 10 between lengths of broadloom or roll goods flooring 54 and 56.

The proportions of upright portion 12 of molding 10 as compared to cross-bar portion 14 may be varied depending on the properties of the flooring being installed and the appearance desired. Of particular visual significance is the width of portion 14, which

establishes the width of the "grout line" seen between adjacent flooring modules. To ensure proper spacing of modules for grouting, 0.080" monofilament line is preferable for use as a spacing device between adjacent modules. Different colors can also be used for molding 10, including colors that sharply contrast with the flooring being installed and colors that match such flooring and provide little contrast. Knurling on wheel 44 will impart a bumpy, but regular surface to molding 10, but a smooth wheel surface will leave molding 10 smooth, among other alternatives.

The thickness and height of upright portion 12 of molding 10 may also be varied depending on the nature of the seal between adjacent modules desired and the properties of the modules. Different textile face flooring modules may have dramatically different faces. For instance, woven textile faces like those disclosed in International Patent Application No. PCT/US98/21487 may be very thin, thus requiring a short upright portion 12, while conventional tufted or fusion bonded textile faces may be substantially thicker, accommodating a taller upright portion 12.

As noted above, entirely different shapes may be used in some installations instead of the T-shape of molding 10. For instance, a flat molding may be used that in effect has no upright portion of the T-shape. Alternatively, a molding might be used that has only the upright portion of the T-shape for positioning in a seam between adjacent flooring without any horizontal, cross-bar, or other molding structure overlying portions of the flooring.

As is well known to those familiar with modular flooring, one of the many attractive attributes of installations of such products is the ease with which small areas of soiled or worn flooring can be replaced by removing and replacing individual modules. This invention produces a flooring installation in which modules (or broadloom or roll-

goods) are bonded by molding 10 to create a unitary installation. It nevertheless remains possible to remove and replace one or more individual modules or other portions of the flooring. For instance, a damaged module can be cut out with a utility knife, and exposed molding 10 can be "peeled" away from portions of the installation to which it is attached, usually as a single strip. A replacement flooring module is then positioned, and appropriate lengths of T-shaped molding 10 are cut to length and positioned between the replacement module and adjacent flooring. Molding 10 is then heated with a hand held heat gun or other heat source and a hand roller is used to compress and (as appropriate) emboss the top surface of molding 10.

The foregoing description of exemplary embodiments according to systems and methods of the invention has been presented only for the purposes of illustration and description and is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in light of the above teaching.

The embodiments were chosen and described in order to explain the principles of the invention and their practical application so as to enable others skilled in the art to utilize the invention and various embodiments and with various modifications as are suited to the particular use contemplated. Alternative embodiments will become apparent to those skilled in the art to which the present invention pertains without departing from its spirit and scope.